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## Fate of Insects in the Midst of ‘Sixth Mass Extinction’: Why It Matters

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### Abstract

“Biological annihilation” of wildlife in recent decades has triggered the sixth mass extinction and the planet is heading towards a ‘global crisis’. In this context, insects, one of the most diverse arthropods have declined 40%, with a third of them being endangered over period of time. Intensive agriculture, urbanization, climate change, anthropocene defaunation, pollution like factors have been proven to be the major causes of anthropocene extinction. So, there is a need to understand the past-present insect diversity, their causes of decline and factors affecting the mass decline and ultimately the aim is to maintain the population beyond their damaging levels.

### Introduction

There has never been a richness of life equivalent to that which exists today in the more than 4.5 billion years of Earth’s history. Despite the fact that there have been five big extinction events in the previous 450 million years, each wiping out 70 to 95 percent of all plant, animal, and microbe species, life has returned and multiplied dramatically. Catastrophic environmental changes, such as huge volcanic eruptions, loss of marine oxygen, or collision with an asteroid, were responsible for those extinction events. It required millions of years in each case to re-establish populations of species equivalent to those that existed prior to the extinction catastrophe. Even though just about 2% of all species that have ever lived are alive now, the total number of species is bigger than it has ever been. We humans developed into such a biologically diverse planet, and it is this world that we are destroying.

### Current Biological Annihilation and Hexapods

Currently earth is under the phenomena of Holocene extinction *i.e.*, sixth mass extinction process predominantly due to anthropogenic activities (that’s why called Anthropocene extinction). A mass extinction is defined as the extinction of roughly three-quarters of all species on the planet in a ‘short’ geological time (less than 2.8 million years). Earth has lost a large number of species in the previous five major extinctions. In the first mass extinction in Ordovician event (440 mya) 85% of all species including marine invertebrates were affected. During the late Devonian period (374 mya) second mass extinction affected 75% of all the species. The largest mass extinction to date happened during the Permian epoch (250 million years ago) owing to an asteroid collision that wiped out 95 percent of all life. During the Jurassic period, 80% of the world’s species became extinct (200 mya; forth mass extinction) (Ceballos *et al.*, 2020). The

most recent mass extinction (the Cretaceous catastrophe) occurred 145 million years ago, resulting in the destruction of 76 percent of all species. A study found that 29,400 terrestrial vertebrate species with fewer than 1,000 individuals are on the edge of extinction. According to the International Union for Conservation of Nature (IUCN) Red List, 42 percent of 3,623 terrestrial invertebrate species, including insects, and 25 percent of 1,306 marine invertebrates are classed as threatened with extinction.

According to reports, insects make up half of the 1 million animal and plant species on the planet that are on the verge of extinction, and their extinction might be disastrous for humanity. More than 40% of insect species are falling, with a third of them being endangered. According to the best evidence available, the total mass of insects is declining at a rate of 2.5 percent every year, implying that they could become extinct within a century. Insect loss has a significant influence for many insectivorous birds, reptiles, amphibians, and fish. Such cascading consequences have previously been observed in Puerto Rico, where a recent research demonstrated a 98 percent reduction in ground insects over the course of 35 years (Ceballos *et al.*, 2017). Only 8,400 species of insects have been assessed by the International Union for Conservation of Nature (IUCN) Red List of Threatened Species, out of a total of one million known to exist. However, based on estimates of 7% extinctions for land snails, insect extinctions since the industrial period are expected to be about 5-10%, *i.e.*, 2,50,000 to 5,00,000 species. At least one million species, half of which are insects, are on the verge of extinction in the coming decades.

### Indian Scenario

The similar trends in India also cannot be ignored as many Indian entomologists also agree that India is already witnessing a slump in insect numbers. In many instances such as, disappearance of a leafhopper genus *Gunhilda* in India, diminishing number of sound producing crickets and tettigonids, local disappearance of flea beetles from Botanical garden, GKVK, Bengaluru, loss of population of many beneficial parasitoids such as *Campoletis chloridae* in chick pea, drastic reduction of fireflies in Dehradun *etc.* indicated that India is not free from such global impact. Amidst all these data, another challenge is significant percentage of the insect world is yet been unexplored. Scientists estimate the number of insect species at about 5.5 million. Only a fifth of them have been identified and named. The number of threatened and extinct insect species is woefully underestimated because so many are rare or undescribed. Nearly 89% of the global insect population has not even been named. Though India is one of the mega-biodiversity countries in the world with unique biogeographical locations, diversified climatic conditions and a wide array of ecosystems from deep-sea to high mountain ranges at the Himalayas harboring huge entomofauna

(Forest ecosystem- 63,733 species, Himalayas- 25,064 spp., Trans-Himalayas Cold desert- 2,291 spp., Islands- 3,572 spp., Desert- 1,577 spp., Semi-Desert- 4,346 spp., mangrove- 1,461, soil- 13,711, agroecosystem- 3,130 spp. and aquatic- 4,976 spp.), all of them have not been identified yet (Chandra, 2020). 'Though the insect diversity of India is comparatively rich and well known, revisionary works on smaller and lesser-known groups are still lacking. There is also a need to write the 'Fauna of India' on the various newly discovered and redesignated families of the economically essential groups, as the 'Fauna of British India' volumes are comparatively old and outdated. Dr. Kailash Chandra, Director, Zoological survey of India also emphasized on the studies on DNA barcoding of insects of economic and conservation significance as well as cryptic species'.

### What Hasten Such Extinction

Intensive agriculture, urbanization and climate change are significant factors leading to such extinction in long term. The other drivers are dwindling and degraded habitat, followed by pollutants - especially insecticides - and invasive species. Anthropocene defaunation, or the global loss of faunal species and populations, as well as the fall in population abundance, has primarily been reported in terrestrial settings, but evidence implies that defaunation has been more severe in freshwater habitats. Although marine defaunation is still in its early stages, its consequences are already noticeable, and its rate of acceleration appears to be on the rise. Defaunation is presently having a major impact on the planet's wildlife, with cascade effects ranging from local to global coextinctions of interacting species to the loss of ecological services vital to civilization. Slowing defaunation will necessitate actively lowering animal overexploitation and habitat degradation, mitigating climatic change, and balancing the effects of human population expansion and uneven resource consumption. To avoid defaunation's current track from sparking the planet's sixth mass extinction, global intervention is required.

### Possible Measures

Many solutions are now available to support insect populations at sustainable levels, especially through preserving and recovering natural habitats, eliminating deleterious agricultural practices including harmful pesticides, implementing measures for avoiding or eliminating the negative impacts of invasive species, taking aggressive steps to reduce greenhouse gas emissions, and curbing the deleterious effects of overexploitation of many taxa. According to Indian State of Forest Report (2019), 16 million ha are protected areas (NPs and WLSs) and 24.56% of the geographic areas are under forest and tree cover which need to be expanded. More awareness among all the stakeholders and collaborative efforts can save this upcoming apocalyptic phase.

## Conclusion

Insect belong to one of the most diverse community on earth, which is currently facing the biological annihilation. Insects contribute to the four main types of ecosystem services such as, provisioning services, supporting services, regulating services and cultural Services. With the loss of biodiversity, the species richness, species evenness is slowly declining but there is a need to identify the factors responsible for such Holocene extinction process and mitigate the mass decline. Thus, apart from adopting sustainable agriculture practices, various adoption and control measures can be adopted to curb the adversities of climate change and a mass decline can be slowed down.

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